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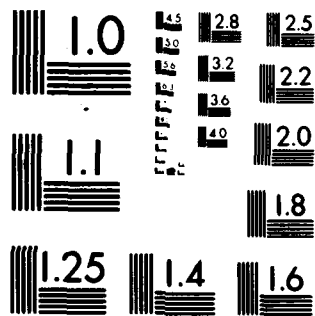
D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA  
NATIONAL DAM INSPECTION PROGRAM. ELROY FACE DAM (NDI ID NUMBER --ETC(U)  
1980 L D ANDERSEN

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## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

**PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM**

**NAME OF DAM:** Elroy Face Dam  
**STATE LOCATED:** Pennsylvania  
**COUNTY LOCATED:** Indiana  
**STREAM:** An Unnamed Tributary of Yellow Creek  
**SIZE CLASSIFICATION:** Small  
**HAZARD CLASSIFICATION:** Significant  
**OWNER:** Eastern Orthodox Foundation  
**DATE OF INSPECTION:** November 28 and December 12, 1979

**ASSESSMENT:** Based on the evaluation of the existing conditions, the condition of Elroy Face Dam is considered to be unsafe/nonemergency. A portion of the embankment crest adjacent to the overflow spillway located on the left abutment was found to be about 3 feet below the design crest level and only 8 inches above normal pool level. Relative to this low spot, the capacity of the spillway is estimated to be 66 cfs (approximately 5 percent of the probable maximum flood), which is significantly less than the lower limit of the recommended spillway design flood of the 100-year flood for the dam, based on its size and hazard classification. Therefore, the spillway capacity is considered to be inadequate.

A preliminary survey of the crest of the dam indicated that the remaining portion of the crest is also below the design level by about one to two feet.

The crest and the downstream face of the dam were found to be covered with thick brush and trees, essentially precluding proper inspection of the embankment. The embankment was generally found to be in poor condition with extensive swampy areas along the downstream toe and shoreline erosion on the upstream side. The spillway structures and the downstream end of the outlet pipe were found to be structurally in poor condition and requiring repairs.

It is recommended that the following measures be implemented immediately or on a continuing basis.

1. The owner should immediately retain a professional engineer experienced in the design and construction of dams to initiate filling of the low spots on the dam and to undertake additional hydrology and hydraulic analyses to determine the nature and extent of improvements required to provide adequate spillway capacity.

2. Brush and trees on the crest, the downstream slope, and the toe of the dam should be cleared, and in view of the observed deficiencies, which suggest the possibility of other deficiencies, the embankment should be reinspected by a professional engineer after this clearing and necessary repairs performed.
3. Structural adequacy of the outlet pipe and spillway structures should be evaluated and necessary repairs should be made.
4. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of emergencies.
5. The dam and appurtenant structures should be inspected regularly and necessary maintenance performed.

*Lawrence D. Andersen*

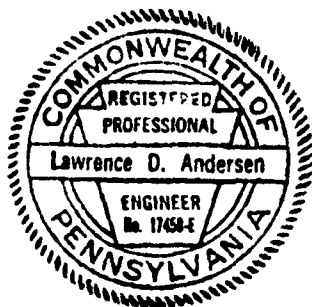
Lawrence D. Andersen, P.E.  
Vice President

January 28, 1980  
Date

Approved by:

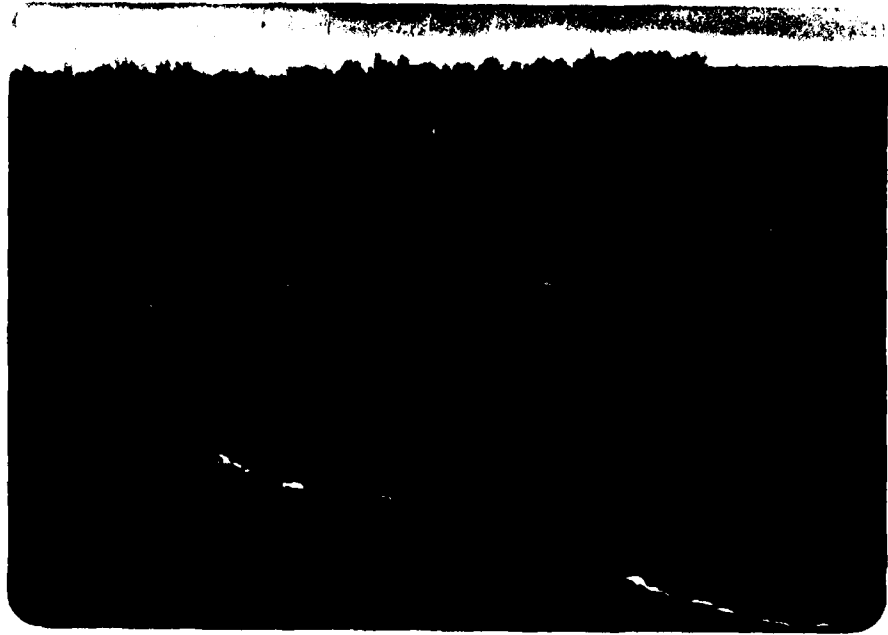
*James W. Peck*  
JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer

25 Feb 1980  
Date

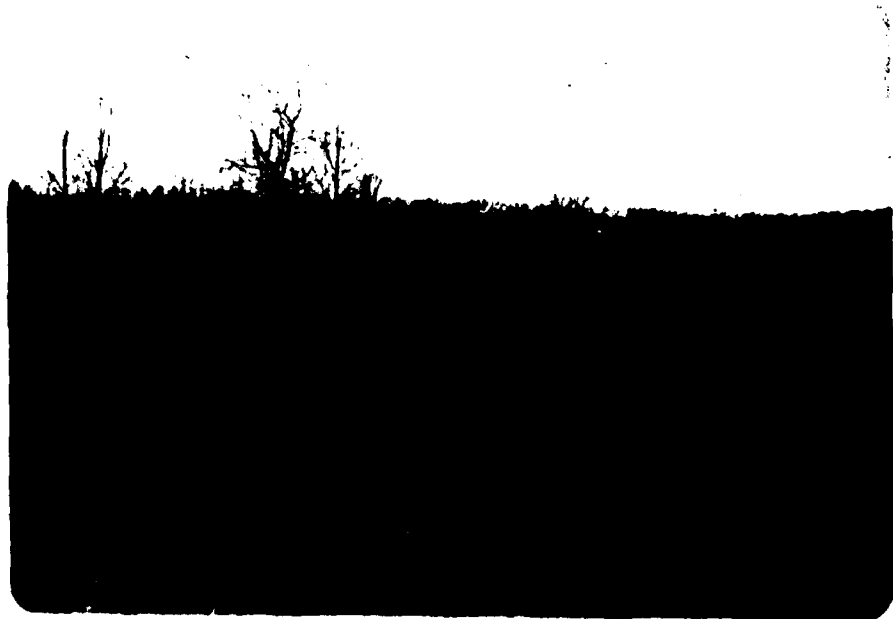


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ELROY FACE DAM  
NDI I.D. PA-281  
NOVEMBER 28, 1979



Upstream Face



Downstream Face

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⑥ National Dam Inspection Program.  
Elroy Face Dam <sup>(VDI ID Number</sup> PA-00281, DER ID  
Number 32-56), Ohio River Basin,  
Unnamed Tributary of Yellow  
Creek, Indiana County,  
Pennsylvania.  
Phase I Inspection Report,

⑪ 1980

⑫ 744

⑩ Lawrence D. Andersen

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PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM  
ELROY FACE DAM  
NDI I.D. PA-281  
DER I.D. 32-56

SECTION 1  
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The Elroy Face Dam consists of an earth embankment approximately 750 feet long with a maximum height of approximately 23 feet from the downstream toe. The crest of the dam is irregular and cambered in the transverse direction with widths varying from 4 to 8 feet. The flood discharge facilities for the dam consist of a drop inlet type primary spillway and an overflow emergency spillway located on the left abutment (looking downstream). The overflow emergency spillway is a stone masonry structure with a flow width of 29 feet. Discharge from the spillway flows into an unprotected discharge channel which flows parallel to the toe of the dam for about 400 feet and terminates at the primary spillway plunge pool. The primary spillway structures, which also serve as the outlet works for the dam, include a reinforced concrete intake tower, which discharges into a 24-inch outlet conduit through the dam, which in turn terminates at a plunge pool at the downstream toe. The flow to the outlet conduit is controlled by stop logs located in the intake tower. The stop logs divide the intake tower into inflow and outflow chambers. The stop logs in the intake tower extend from the invert elevation of the outlet conduit to the normal pool elevation. The flow entering into the intake chamber of the tower rises to the normal pool elevation, spills over the stop logs into the outflow chamber, which in turn discharges into the outlet conduit. During this inspection, the top of the stop logs in the primary spillway intake tower was found to be approximately one to two inches below the emergency spillway crest level. The primary spillway structures also serve as outlet facilities.

The reservoir can be lowered below the normal pool elevation by removing the stop logs. The intake tower is not equipped with any mechanical devices for removing the stop logs.

b. Location. The dam is on an unnamed tributary of Yellow Creek, approximately one-half mile upstream from its confluence with Yellow Creek, in Cherry Hill Township, Indiana County, Pennsylvania. Plate 1 illustrates the location of the dam.

c. Size Classification. Small (based on 23-foot height and 118 acre-feet maximum storage capacity).

d. Hazard Classification. The dam is classified to be in the significant hazard category. The stream below the dam flows through an uninhabited valley for approximately one-half mile, where it joins Yellow Creek. Approximately 2000 feet downstream from this confluence, Yellow Creek flows under U.S. Route 422 and then discharges into Yellow Creek State Park Dam reservoir. A campground is located near the U.S. Route 422 bridge over Yellow Creek. A failure of this dam would damage the bridge over U.S. Route 422 and cause property damage in the adjacent campgrounds. Loss of a few lives is possible.

The downstream Yellow Creek State Park Dam impounds a reservoir with a storage capacity of 13,800 acre-feet at normal pool level and 37,800 acre-feet at maximum pool level. The maximum storage capacity of Elroy Face Dam is estimated to be 118 acre-feet. Therefore, failure of Elroy Face Dam would not significantly affect the area downstream of Yellow Creek State Park Dam.

e. Ownership. Eastern Orthodox Foundation, (address: 422 East, Penn Run, Box 432, Indiana, Pennsylvania, 15701).

f. Purpose of Dam. Recreation.

g. Design and Construction History. The dam was designed by Mr. G. J. Horak, the original owner of the dam, in 1938. The records indicate that the construction of the dam had started in 1939, and as of 1954, the construction had not been completed.

h. Normal Operating Procedure. As it presently exists, the reservoir is maintained at the level of the uncontrolled primary spillway crest elevation which also corresponds to the crest elevation of the uncontrolled emergency spillway. According to the design drawings, the emergency spillway crest is located at Elevation 1465, which was found to be not in conformance with the normal pool elevation (El. 1445) interpolated from the USGS 7.5-minute Strongstown quadrangle map.

1.3 Pertinent Data. Elevations referred to in this section and subsequent sections of the report were calculated based on approximate field measurements assuming the normal pool level to be at Elevation 1445 (USGS Datum) which is interpolated from USGS 7.5-minute quadrangle maps.

a. <u>Drainage Area</u>	0.7 square miles
b. <u>Discharge at Dam Site (cfs)</u>	
Maximum known flood at dam site	Unknown
Outlet conduit at maximum pool	22
Gated spillway capacity at maximum pool	Not applicable
Ungated spillway capacity at maximum pool	44
Total spillway capacity at maximum pool	66
c. <u>Elevation, USGS Datum (feet)</u>	
Top of Dam	1445.7 (measured low spot)
Maximum pool	1445.7
Normal pool	1445.0
Upstream inlet outlet works	1420+
Downstream inlet outlet works	1419+
Streambed at center line of dam	1419
Maximum tailwater	Unknown
d. <u>Reservoir Length (feet)</u>	
Normal pool level	1300
Maximum pool level	1300
e. <u>Storage (acre-feet)</u>	
Normal pool level	98
Maximum pool level	118
f. <u>Reservoir Surface (acres)</u>	
Normal pool level	19.3
Maximum pool level	20 +
g. <u>Dam</u>	
Type	Earth
Length	750 feet
Height	23 feet
Top width	4 to 8 feet

**Side slopes**

**Downstream:**

**2 Horizontal:**

**1 Vertical**

**Upstream:**

**Undefined**

**Zoning**

**Yes**

**Impervious core**

**Yes**

**Cutoff**

**Yes**

**Grout curtain**

**No**

**h. Regulating Outlet.(24-Inch Outlet Conduit)**

**Length**

**100 feet +**

**Closure**

**Stop logs**

**Access**

**Intake tower**

**Regulating facilities**

**Stop logs**

**i. Spillway**

**Type**

**Concrete over-  
flow section**

**Length**

**29 feet**

**Crest elevation**

**1445**

**Gates**

**None**

**Upstream channel**

**Lake**

**Downstream channel**

**Earth channel**

## SECTION 2 DESIGN DATA

### 2.1 Design

a. Data Available. The available information was provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER). The information includes correspondence, state inspection reports, and design drawings.

(1) Hydrology and Hydraulics. No design information is available. A state report entitled, Report Upon the Application of G. J. Horak, gives the original design capacity of the spillway.

(2) Embankment. Available information consists of design drawings.

(3) Appurtenant Structures. The available information includes design drawings.

#### b. Design Features

(1) Embankment. As designed, the dam (Plate 2) is a zoned embankment consisting of a central clay core with clay and shale fill sections upstream and downstream (Plate 3). Although not shown in the design drawings, a state construction progress report indicates that a small cutoff trench, approximately 4 feet deep, was excavated along the center line of the dam beneath the clay core section.

A design drawing (Plate 4) indicates at least three borings were drilled along the center line of the dam for subsurface investigation. According to the subsurface investigation, the subsurface profile is shown to consist of a five-foot layer of clay underlain by brown shale and rock.

The design drawings show the embankment slopes to be 2 horizontal to 1 vertical on both the upstream and downstream faces. While the upstream slope is shown to be protected by riprap, the downstream slope was to be sodded with riprap slope protection along the toe of the dam.

(2) Appurtenant Structures. The appurtenant structures of the dam consist of a drop inlet primary spillway, which also incorporates the outlet works facilities, and an emergency spillway located on the left abutment. The details of the emergency spillway overflow structure is illustrated in Plate 5. In this drawing, the

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spillway overflow structure is shown to consist of an ogee overflow section. However, the existing spillway does not conform to this detail and it consists of a broad-crested overflow section.

The combined primary spillway and outlet works structures are located at the center of the embankment and consist of a concrete intake structure on the upstream side of the embankment which discharges into a 24-inch conduit through the embankment. The design drawings and construction progress reports indicate that the outlet conduit consisted of a 24-inch corrugated metal pipe encased in reinforced concrete. Design drawings (Plate 3) show that three concrete cutoff collars were provided on the upstream half of the outlet conduit. The flow through the outlet conduit is controlled by stop logs in the control tower. The stop logs extend from the upstream invert elevation of the outlet conduit to the normal pool elevation. The lake can be lowered by removing the stop logs from the intake tower. The intake tower is not equipped with any mechanical device for removing the stop logs.

c. Design Data.

(1) Hydrology and Hydraulics. The available information includes no hydrology and hydraulic analyses. However, a state report, dated 1938, indicates that the spillway was sized to pass 600 cfs.

(2) Embankment. Other than design drawings, no engineering data are available on the design of the embankment.

(3) Pertinent Data. The available information consists of design drawings only.

2.2 Construction. Available records indicate that the construction of the dam was started in 1939, and as of 1954, it was still under construction. A state report dated 1942 indicates that the dam was being constructed by the owner and his sons in their spare time. No detailed information is available on the manner in which the embankment was constructed. Some state construction progress reports indicate that the embankment was compacted by dozers.

Field observations indicate that the overflow spillway structures have not been constructed in conformance with the design drawings. Further, it appears that the embankment has never been completed to its original design crest level. During this inspection, the crest of the dam was found to be on the order of one to two feet below the emergency spillway sidewall elevation, which appears to be the original design crest elevation for the dam.

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2.3 Operation No operating records have been kept for the dam. A missing embankment section adjacent to the emergency spillway wall suggests that the dam might have been overtopped in the past.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. The available information was provided by the Commonwealth of Pennsylvania Department of Environmental Resources.

b. Adequacy.

(1) Hydrology and Hydraulics. The existing spillway is not in conformance with the design drawings. Therefore, available data are not applicable to the current configuration of the spillway.

(2) Embankment. Design documents lack such considerations as embankment slope stability and seepage analysis and other quantitative data to aid in evaluating the adequacy of the design. Further, the fact that the dam was built over a long period of time, from 1939 to approximately 1954 on a part-time basis by the original owner, raises concern as to the adequacy of the construction. In view of these conditions, the design and construction of the dam are not considered to be in conformance with currently accepted engineering practices.

(3) Appurtenant Structures. The available information, which consists of design drawings only, is not considered to be adequate to assess the structural adequacy of the primary and emergency spillway structures. The manner in which the outlet conduit is reported to have been constructed, corrugated metal pipe encased in concrete, raises concerns as to its continued ability to carry loads imposed by the embankment, particularly since serious deterioration of the structure was observed at the downstream end.



## SECTION 3 VISUAL INSPECTION

### 3.1 Findings

a. General. The on-site inspection of Elroy Face Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.
2. Visual examination of the emergency spillway and the downstream end of the outlet conduit.
3. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 6.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

The crest, downstream slope, and toe area of the dam were found to be covered with dense brush which precluded proper inspection of the embankment. The most significant condition noted at the dam site was the presence of a low area on the crest of the dam adjacent to the emergency spillway. This section was found to be only 8 inches above the normal pool level. Observations suggest that this portion of the embankment may have been overtopped and eroded in the past. The crest of the dam is irregular in the transverse direction, generally lower on the upstream side and higher on the downstream side. The crest width varies from 4 to 8 feet. At various locations, the upstream slope was found to be almost vertical at the water level and eroding due to wave action. Along the toe of the dam, extensive swampy areas were observed. However, no concentrated seepage points were found to be associated with these swampy areas. A depression, which appears to be an old sinkhole or erosion scar, was identified near the right abutment along the toe. It is presumed that this depression was caused by runoff from the highway culvert located on the right abutment which generally flows along the toe of the embankment.

The top of the dam was surveyed relative to the emergency spillway crest and was found to be very irregular. The crest profile of the dam is illustrated in Plate 7.

c. Appurtenant Structures. The spillway and outlet works were examined for deterioration or other signs of distress and obstructions that would limit flow. In general, these structures were found to be in poor condition and do not appear to have been constructed in conformance with the design drawings. A major structural crack was found in the masonry wall of the emergency spillway on the embankment side, while a portion of the wall was found to be missing on the left abutment side. Some underseepage, approximately 5 gallons per minute, was noted below the spillway overflow section. The spillway discharge channel consists of a small earth channel with no erosion protection. Severe erosion exists at various locations along the channel.

The downstream end of the outlet conduit was observed and found to be in poor condition. Reinforcing bars protruding from the concrete encasement of the conduit suggest that at least 5 to 6 feet of concrete has eroded in the past. The outlet conduit discharges into a plunge pool with no erosion protection.

d. Reservoir Area. A map review and field observations indicate that there are numerous small ponds located upstream from the dam. However, the size of the ponds is not considered to be significant relative to hydraulic performance of Elroy Face Dam. A review of the regional geology (Appendix F) and visual observations indicate that the reservoir slopes are gentle and are not likely to be susceptible to massive landslides which would affect the storage volume of the reservoir.

e. Downstream Channel. Discharge from the dam flows through an uninhabited valley for approximately 1/2 mile, where it discharges into Yellow Creek. A further description of the downstream conditions is included in Section 1.2 (d).

3.2 Evaluation. The condition of the dam and its appurtenant structures is considered to be poor. Dense brush on the crest and downstream slope of the dam was found to preclude proper inspection of the facilities. It is recommended that the owner should immediately retain the services of a professional engineer for rehabilitation and restoration of the dam. Filling of the low spots on the crest of the dam to provide adequate freeboard, evaluation of the swampy conditions and the stability of the dam, and restoration of the spillway and outlet structure facilities should be considered.

## SECTION 5 HYDRAULICS AND HYDROLOGY

### 5.1 Evaluation of Features

a. Design Data. Elroy Face Dam has a watershed of 0.7 square miles and impounds a reservoir with a surface area of 19 acres at normal pool level. The flood discharge facilities for the dam consist of a drop inlet type primary spillway and an overflow spillway located on the left abutment. The combined capacity of these spillways is estimated to be 66 cfs, based on the available head relative to the low spot on the crest of the dam.

b. Experience Data. As previously stated, Elroy Face Dam is classified as a small dam in the significant hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass the 100-year flood to half of the PMF.

The PMF inflow hydrograph for the reservoir was determined utilizing the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. The data used for the computer analysis are presented in Appendix D. The one-half PMF inflow hydrograph was found to have a peak flow of 813 cfs. The 100-year flood calculated according to the recommended procedure was found to have a peak flow of 520 cfs. Computer input and summary of computer output for the PMF and 100-year flood routing and the 100-year peak flood calculations are included in Appendix D.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate the capacity of the spillways would be significantly reduced in the event of a flood.

d. Overtopping Potential. Various percentages of the PMF inflow hydrograph were routed through the reservoir and it was found that the spillway can pass about 5 percent of the PMF without overtopping the embankment. The 100-year flood was routed through the reservoir and it was found that the low spot on the dam would be overtopped for a duration of 10.2 hours, with a maximum depth of 1.1 feet. For 50 percent of the PMF, the dam would be overtopped for a duration of 14.8 hours, with a maximum depth of approximately 1.5 feet. Further analysis conducted assuming the low spots on the crest of the dam to be filled to a level of 3.7 feet above the emergency spillway crest level, which appears to be the design crest elevation for the dam, indicates that the spillway would pass over 50 percent of the PMF without overtopping the embankment.

## SECTION 4 OPERATIONAL FEATURES

4.1 Procedure. There are no formal operating procedures for the dam. As it presently exists, the reservoir is maintained at the uncontrolled primary spillway crest level, with excess inflow discharging through the primary and emergency spillways.

4.2 Maintenance of the Dam. Maintenance of the dam is considered to be nonexistent. The crest and downstream face of the dam are covered with dense brush which precludes proper inspection of the embankment.

4.3 Maintenance of Operating Facilities. The maintenance of the operating facilities is also considered to be nonexistent. Both the spillway and outlet conduit structures have seriously deteriorated and do not appear to have been maintained in the past. There is no access to the primary spillway intake structure.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available at the site.

4.5 Evaluation. The overall maintenance condition of the dam and its appurtenances is considered to be poor. It is recommended that the owner prepare a plan for operation and maintenance of the dam.

c. Spillway Adequacy. Since the available spillway capacity is significantly less than the lower limit of the recommended spillway design flood range of the 100-year flood to 50 percent of the PMF, the spillway is classified to be inadequate.

## SECTION 6 STRUCTURAL STABILITY

### 6.1 Evaluation of Structural Stability

#### a. Visual Observations

(1) Embankment. As discussed in Section 3, although numerous deficiencies were noted, none were considered to be serious relative to the stability of the dam at this time.

(2) Appurtenant Structures. The structural condition of the spillway structures at the outlet conduit is considered to be poor, requiring further investigation.

#### b. Design and Construction Data

(1) Embankment. The available information does not include any quantitative data to aid in the assessment of the structural stability of the dam. Further, the manner in which the dam was constructed, on a part-time basis by the owner, over approximately 16 years, raises concern as to the adequacy of its construction. However, as noted previously, no conditions were observed that would significantly affect the stability of the dam. It was also noted that due to dense brush and trees on the crest and downstream of the dam, the condition of the dam could not be properly inspected. Therefore, the static stability of the dam should be evaluated based on reinspection of the dam.

(2) Appurtenant Structures. Available information does not include adequate data to assess the structural adequacy of the appurtenant structures. The structural adequacy of these facilities should be reevaluated in conjunction with the recommended further investigation.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. None reported.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observation, the static stability of the dam appears to be adequate. Therefore, based on recommended criteria for the evaluation of seismic stability of dams, the structure is presumed to present no hazards from earthquakes.

**SECTION 7**  
**ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES**

**7.1 Dam Assessment**

a. Assessment. The visual observations indicate that the Elroy Face Dam is in poor condition. Due to inadequate spillway capacity (5 percent of the PMF) and various structural deficiencies in the spillway and outlet works structures, the condition of the dam is considered to be unsafe/nonemergency. The embankment is considered to be in poor condition with extensive swampy areas along the downstream toe, shoreline erosion on the upstream side, and highly irregular dam crest. The presence of dense brush and trees on the crest and downstream slope of the dam precluded adequate inspection of the embankment. In view of these conditions, further investigation of the dam by a professional engineer is recommended.

b. Adequacy of Information. Available information, in conjunction with visual observations, is considered to be sufficient to make the following recommendations.

c. Urgency. The following recommendations should be implemented immediately or on a continuing basis.

d. Necessity for Additional Data. In view of the conditions described above, the owner should immediately retain the services of a professional engineer to initiate additional studies to determine the extent of the improvements required to provide adequate spillway capacity and restore and rehabilitate the spillway and outlet structures and inspect and reevaluate the condition of the embankment.

**7.2 Recommendations/Remedial Measures**

It is recommended that the following recommendations be implemented immediately or on a continuing basis:

1. The owner should immediately retain a professional engineer experienced in the design and construction of dams to initiate filling of the low spots on the dam and to undertake additional hydrology and hydraulic analyses to determine the nature and extent of improvements required to provide adequate spillway capacity.

2. Brush and trees on the crest, the downstream slope, and the toe of the dam should be cleared, and in view of the observed deficiencies, which suggest the possibility of other deficiencies, the embankment should be reinspected by a professional engineer after this clearing and necessary repairs performed.
3. Structural adequacy of the outlet pipe and spillway structures should be evaluated and necessary repairs should be made.
4. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of emergencies.
5. The dam and appurtenant structures should be inspected regularly and necessary maintenance performed.



**APPENDIX A**  
**CHECKLIST**  
**VISUAL INSPECTION**  
**PHASE I**

# APPENDIX A

## CHECKLIST VISUAL INSPECTION PHASE I

NAME OF DAM Elroy Face Dam COUNTY Indiana STATE Pennsylvania ID# PA 281  
 TYPE OF DAM Earth HAZARD CATEGORY Significant DER 32-56  
 DATE(S) INSPECTION November 28, 1979 WEATHER Cloudy TEMPERATURE 30s

POOL ELEVATION AT TIME OF INSPECTION 1445 M.S.L. TAILWATER AT TIME OF INSPECTION 1419 ± M.S.L.

### INSPECTION PERSONNEL:

REVIEW INSPECTION PERSONNEL: (December 12, 1979)

<u>Bilgin Erel</u>	<u>L. D. Andersen</u>
<u>Wah-Iak Chan</u>	<u>J. H. Poellot</u>
<u></u>	<u>B. Erel</u>

Bilgin Erel RECORDER

VISUAL INSPECTION  
PHASE 1  
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None (the downstream face and the toe of the dam are covered with dense brush and trees which precluded proper inspection of the embankment).	The brush and trees should be removed and the embankment should be reinspected.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None (conditions same as above).	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	It appears that a portion of the embankment adjacent to the emergency spillway has overtopped in the past. There are several erosion ditches on the downstream face near the right abutment.	The crest of the dam and erosion rills should be filled.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	See Plate 7 for dam crest profile.	
RIPRAP FAILURES	At numerous points along the upstream face, riprap is missing.	

VISUAL INSPECTION

PHASE 1

EMBANKMENT

OBSERVATIONS

VISUAL EXAMINATION OF JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	No signs of distress.	
ANY NOTICEABLE SEEPAGE	Extensive swampy areas below the toe of the dam. See Plate 6 for locations.	This area should be closely observed in conjunction with periodic inspections.
STAFF GAGE AND RECORDER	None	
DRAINS	None	

VISUAL INSPECTION  
PHASE 1  
OUTLET WORKS

VISUAL EXAMINATION OF CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	The concrete at the downstream end of the outlet conduit has seriously deteriorated. It appears that at least a five- to six-foot section of the pipe has eroded.	Structural adequacy of the conduit should be assessed and the necessary repairs performed.
INTAKE STRUCTURE	Submerged.	
OUTLET STRUCTURE	Outlet pipe discharges into a plunge pool with no erosion protection.	The plunge pool should be provided with adequate erosion protection.
OUTLET CHANNEL	No apparent obstructions in the outlet channel that would significantly affect the discharge capacity of the outlet works.	
EMERGENCY GATE	The lake can be drawn down by removing the stop logs in the intake tower. There are no mechanical devices for removing the stop logs. The intake tower was inaccessible for inspection. The condition of the stop logs could not be assessed.	

VISUAL INSPECTION  
PHASE I  
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	A 29-foot-wide masonry structure in poor condition.	Major repairs are required.
APPROACH CHANNEL	Submerged. It appeared to be free of debris.	
DISCHARGE CHANNEL	An earth channel with no erosion protection. In poor condition.	The discharge channel should be provided with erosion protection.
BRIDGE AND PIERS	None	

VISUAL INSPECTION  
 PHASE I  
 GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

VISUAL INSPECTION  
PHASE I  
INSTRUMENTATION

VISUAL EXAMINATION OF MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	



VISUAL INSPECTION  
PHASE I  
RESERVOIR  
OBSERVATIONS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle. No significant shoreline erosion was noted.	
SEDIMENTATION	Unknown	
UPSTREAM RESERVOIRS	There are numerous small ponds immediately upstream from the reservoir. None is considered to be hydraulically significant.	

VISUAL INSPECTION  
PHASE I  
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No apparent obstructions immediately downstream from the dam that would affect the discharge capacity of the spillway.	
SLOPES	Serious erosion at various locations along the spillway discharge channel.	Spillway discharge channel should be provided with erosion protection.
APPROXIMATE NUMBER OF HOMES AND POPULATION	There are no inhabitable structures in the potential flood plain downstream from the dam. A bridge on U.S. Route 422 and a camping area are located approximately 3/4 mile downstream from the dam.	

C

**APPENDIX B**  
**CHECKLIST**  
**ENGINEERING DATA**  
**DESIGN, CONSTRUCTION, OPERATION**  
**AND HYDROLOGIC AND HYDRAULIC**  
**PHASE I**

# APPENDIX B

## CHECKLIST

### ENGINEERING DATA

#### DESIGN, CONSTRUCTION, OPERATION

##### PHASE I

NAME OF DAM Elroy Face Dam

ID# PA 281

DER 32-56

ITEM	REMARKS
AS-BUILT DRAWINGS	The design drawings are available in the state files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by the original owner, Mr. G. J. Horak, in 1938. The dam was constructed over a period of 16 years, from 1938 to 1954.
TYPICAL SECTIONS OF DAM	See Plate 3
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plate 3

CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Not available.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See Plate 4 for the typical subsurface profile.

**CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I**

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	Not recorded.

CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported; however, visual observations indicate that the embankment may have overtopped in the past adjacent to the emergency spillway.
MAINTENANCE OPERATION RECORDS	Not available.
SPILLWAY PLAN SECTIONS DETAILS	See Plate 5.
OPERATING EQUIPMENT PLANS AND DETAILS	See Plate 3.

**CHECKLIST  
ENGINEERING DATA  
HYDROLOGIC AND HYDRAULIC**

**DRAINAGE AREA CHARACTERISTICS:** .7 square miles

**ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY:** 1445 - 98 acre-feet

**ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY:** 1445.7

**ELEVATION; MAXIMUM DESIGN POOL:** 1449 ± (assumed dam crest elevation)

**ELEVATION; TOP DAM:** 1445 (measured low spot)

**SPILLWAY:**

a. Elevation 1445

b. Type Concrete overflow

c. Width 29 feet

d. Length Not applicable

e. Location Spillover Adjacent to emergency spillway

f. Number and Type of Gates None

**OUTLET WORKS:**

a. Type 24-Inch corrugated metal pipe

b. Location Center of embankment

c. Entrance Inverts \_\_\_\_\_

d. Exit Inverts \_\_\_\_\_

e. Emergency Draindown Facilities Outlet conduit

**HYDROMETEOROLOGICAL GAGES:**

a. Type None

b. Location None

c. Records None

**MAXIMUM NONDAMAGING DISCHARGE:** 66 cfs (existing spillway capacity)



**APPENDIX C**  
**PHOTOGRAPHS**

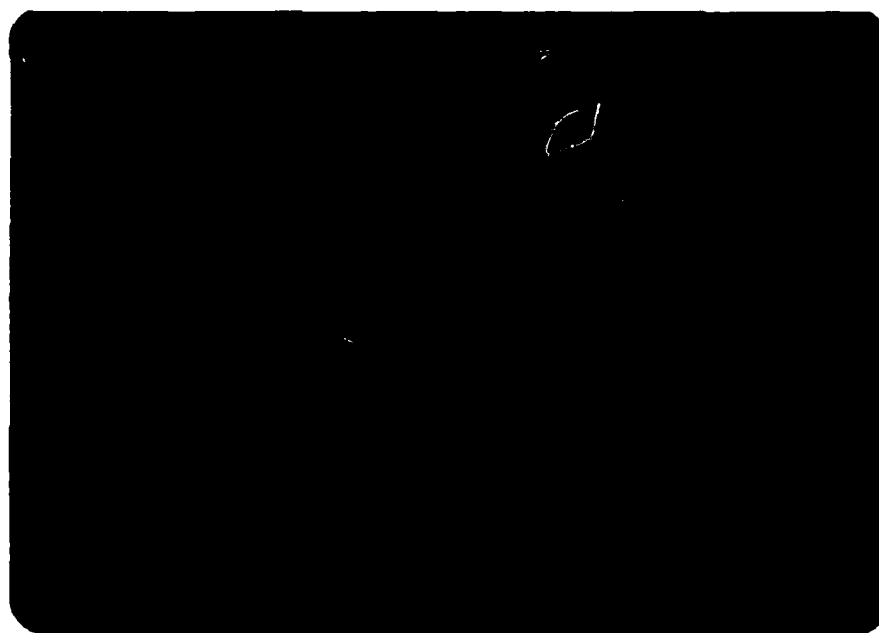
LIST OF PHOTOGRAPHS  
ELROY FACE DAM  
NDI I.D. PA-281  
NOVEMBER 28, 1979

<u>PHOTOGRAPH NO.</u>	<u>DESCRIPTION</u>
1	Dam crest.
2	Primary spillway intake.
3	Emergency spillway.
4	Emergency spillway discharge channel.
5	Emergency spillway plunge pool.
6	Primary spillway outlet pipe. Note deteriorating concrete.
7	Low spot on dam crest. Top of concrete is 0.7 foot above normal pool level.
8	Route 422, 0.7 mile downstream.



Photograph No. 1

Dam crest.

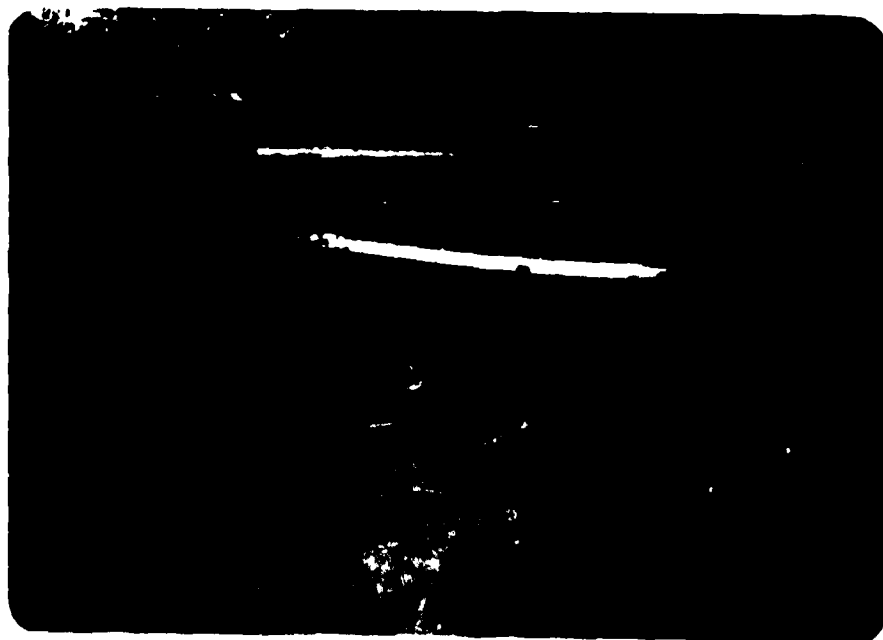


Photograph No. 2

Primary spillway intake.



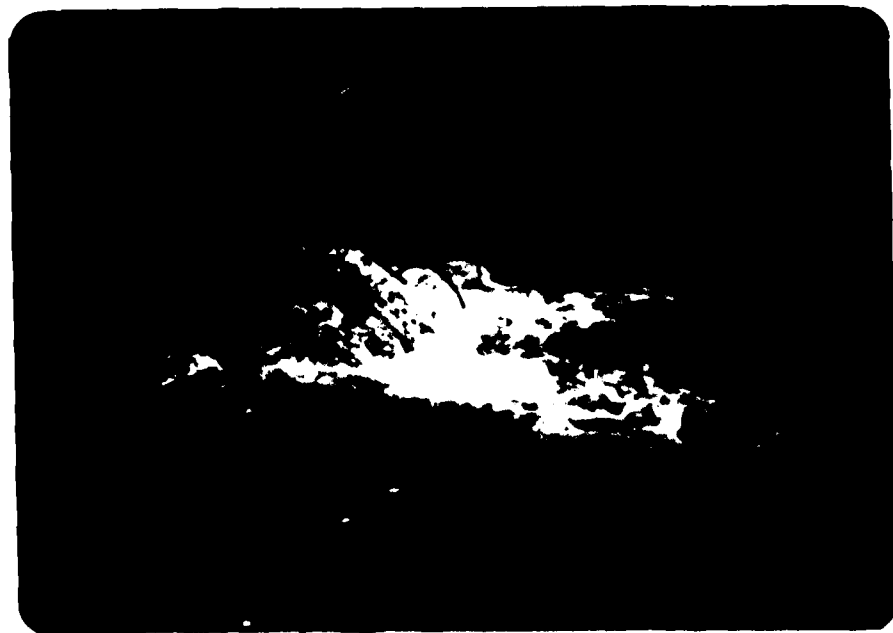
Photograph No. 3  
Emergency spillway.



Photograph No. 4  
Emergency spillway discharge channel.



Photograph No. 5  
Emergency spillway plunge pool.



Photograph No. 6  
Primary spillway outlet pipe. Note deteriorating concrete.



Photograph No. 7

low spot on dam crest. Top of concrete  
is 0.7 foot above normal pool level.



Photograph No. 8

Route 422, 0.7 mile downstream.

**APPENDIX D**  
**HYDROLOGY AND HYDRAULICS ANALYSES**

HYDROLOGY AND HYDRAULIC ANALYSIS  
DATA BASE

NAME OF DAM: Elroy Face Dam (NDI - I.D. PA 281)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.7 INCHES/24 HOURS<sup>(1)</sup>

STATION	1	2	3	4	5
Station Description	Lake	Elroy Face Dam			
Drainage Area (square miles)	0.7	-			
Cumulative Drainage Area (square miles)	0.7	0.7			
Adjustment of PMP for Drainage Area (2) <sup>(2)</sup>					
6 Hours	102				
12 Hours	120	-			
24 Hours	130				
48 Hours	140				
72 Hours	-				
Snyder Hydrograph Parameters					
Zone <sup>(3)</sup>	24				
$C_p/C_t$ <sup>(4)</sup>	0.45/1.6				
L (miles) <sup>(5)</sup>	1.4	-			
$L_{ca}$ (miles) <sup>(5)</sup>	0.6				
$t_p = C_t(L - L_{ca})^{0.3}$ (hours)	1.5				
Spillway Data					
Crest Length (ft)		41.25 <sup>(5)</sup>			
Freeboard (ft)	-	0.7			
Discharge Coefficient		2.75			
Exponent		1.5			

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients ( $C_p$  and  $C_t$ ).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.

$L_{ca}$  = Length of water course from outlet to point opposite the centroid of drainage area.

STORAGE VS. ELEVATION

ELEVATION	$\Delta H$ , FEET	AREA (ACRES) (1)	$\Delta VOLUME$ (ACRE-Feet) (2)	STORAGE (ACRE-Feet)
1460		37.6		517.4
1445 <sup>(3)</sup>	.5	19.3	419.2	98.2
	-		98.2 <sup>(4)</sup>	
Lake Bottom		-		0

(1) Planimetered from USGS maps.

(2)  $\Delta Volume = \Delta H/3 (A_1 + A_2 + \sqrt{A_1 A_2})$ .

(3) Normal pool elevation is interpolated from USGS maps.

(4) From Pennder files.

(5) Equivalent crest length for primary and emergency spillways. See calculations on Pages D11 and D12 of 12.



\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 26 FEB 79  
 \*\*\*\*\*

1	A1	SNYDER UNIT HYDROGRAPH, FLOOD ROUTING AND DAM OVERTOPPING ANALYSES									
2	A2	ELROY FACE DAM, INDIANA COUNTY. NDI-I.O.PA.281 PROJECT NO.79-543-15									
3	A3	FOR 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, AND 50% PMF									
4	B	300	0	10	0	0	0	0	0	-4	0
5	B1	5									
6	J	1	9	1							
7	J1	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.50	
8	K	0	1								
9	K1	CALCULATION OF SNYDER INFLOW HYDROGRAPH TO LAKE MARGUS									
10	M	1	1	0.70	0.70	130	140	1.0	.05	0.0429	
11	P	23.7	102	120	120	130	140	1.0	.05	0.0429	
12	T										
13	U	1.52	0.45								
14	X	-1.0	-0.05	2.0							
15	K	1	2								
16	K1	ROUTING FLOW THROUGH ELROY FACE DAM (NDI-I.O.PA.281)									
17	V	1	1								
18	V1	1									
19	SS	0.0	98.2	517.4							
20	SE1417.0	1445.0	1445.0	1460.0							
21	SE1445.0	41.25	2.75		1.5						
22	SE1445.7	3.08	1.5	750.0							
23	SL	1.0	37.0	137.0	212.0	312.0	350.0	525.0	625.0	725.0	750.0
24	SV1445.7	1446.3	1446.7	1446.8	1446.9	1447.2	1447.3	1447.6	1447.7	1450.0	
25	K	99									

# COMPUTER INPUT OVERTOPPING ANALYSIS

PAGE D2 of 12

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 FROM CO. 1 FURNISHED TO DDC

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS													
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9					
				.05	.10	.15	.20	.25	.30	.35	.40	.50					
HYDROGRAPH AT	1	.70	1	81.	163.	244.	325.	406.	488.	569.	650.	813.					
	(	1.81)	(	2.30)	(	6.91)	(	9.21)	(	11.51)	(	13.81)	(	16.11)	(	18.41)	(
ROUTED TO	2	.70	1	54.	122.	198.	279.	364.	451.	540.	626.	794.					
	(	1.81)	(	1.52)	(	3.47)	(	7.90)	(	10.30)	(	12.78)	(	15.30)	(	17.73)	(

FLOOD ROUTING SUMMARY

PAGE D3 of 12

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PLAN 1 .....

RATIO OF PPF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 1445.00 98. 0.	SPILLWAY CREST 1445.00 98. 0.	TOP OF DAM 1445.70 111. 06.	DURATION OVER TOP HOURS	MAX OUTFLOW CFS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1445.61	0.00	115.		0.00	54.	41.33	0.00
.10	1446.01	.31	120.		5.23	122.	43.00	0.00
.15	1446.30	.67	135.		9.17	192.	42.67	0.00
.20	1446.53	.83	141.		9.83	279.	42.50	0.00
.25	1446.71	1.01	146.		11.17	264.	42.17	0.00
.30	1446.84	1.14	150.		12.33	451.	41.83	0.00
.35	1446.94	1.24	152.		12.53	540.	41.67	0.00
.40	1447.02	1.32	155.		13.50	626.	41.67	0.00
.50	1447.15	1.45	158.		14.23	794.	41.50	0.00

## OVERTOPPING SUMMARY ANALYSIS

**PAGE D4 of 12**

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO	RATIOS APPLIED TO PRECIPITATION		
					1	2	3
					.90	1.00	1.10
HYDROGRAPH AT	1	.70	1	466.	520.	574.	
	(	1.81)	(	13.19)	( 14.72)	( 16.24)	(
ROUTED TO	2	.70	1	379.	442.	507.	
	(	1.81)	(	10.73)	( 12.52)	( 14.35)	(

FLOOD ROUTING SUMMARY

PAGE D6 of 12

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# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 1445.00 98. 0.	SPILLWAY CREST 1445.00 98. 0.	TOP OF DAM 1445.70 118. 66.	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
					.90	1446.73	1.03	147.	379.	9.33	25.83	0.00
					1.00	1446.83	1.13	149.	442.	10.17	25.83	0.00
					1.10	1446.90	1.20	151.	507.	11.33	25.67	0.00

OVERTOPPING ANALYSIS SUMMARY

PAGE D7 of 12

# D'APOLONIA

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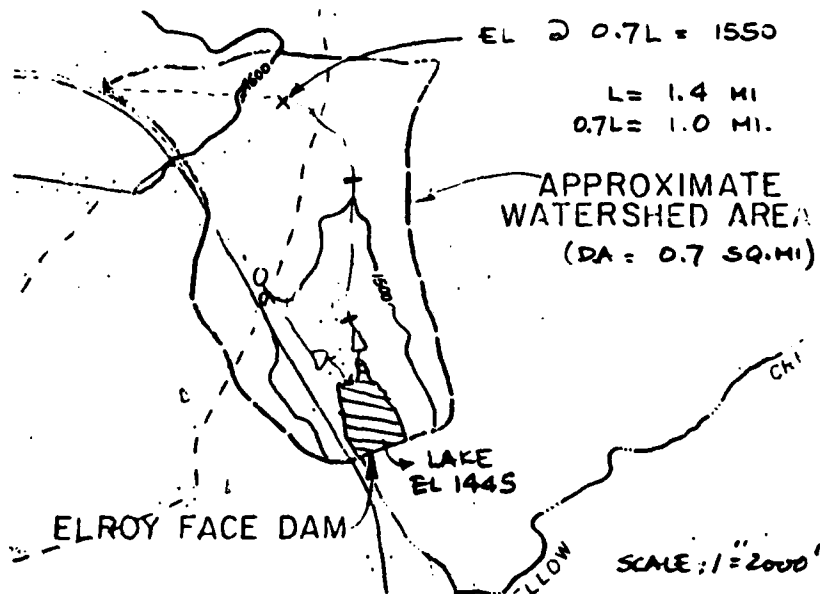
By BE Date 1/18/80 Subject ELROY FACE DAM Sheet No. 1 of 1  
 Chkd. By            Date            100-YEAR FLOOD. Proj. No. 79-543-10

100-YEAR FLOOD PEAK PER COE REGRESSION ANALYSIS

$$Q_{100} = 120.38 (D.A \times S^{1/2})^{0.744} \text{ cfs.}$$

WHERE

D.A = DRAINAGE AREA IN SQ. MI.  
 S = SLOPE OF FIRST 0.7 X LENGTH  
 REACH IN FT/MILE.



$$\text{SLOPE} = \frac{1550 - 1445}{0.7L} = \frac{105}{1} = 105 \text{ FT/MILE}$$

$$Q_{100} = 120.38 (0.7 \times \sqrt{105})^{0.744} = 521 \text{ cfs}$$

D 8 OF 12

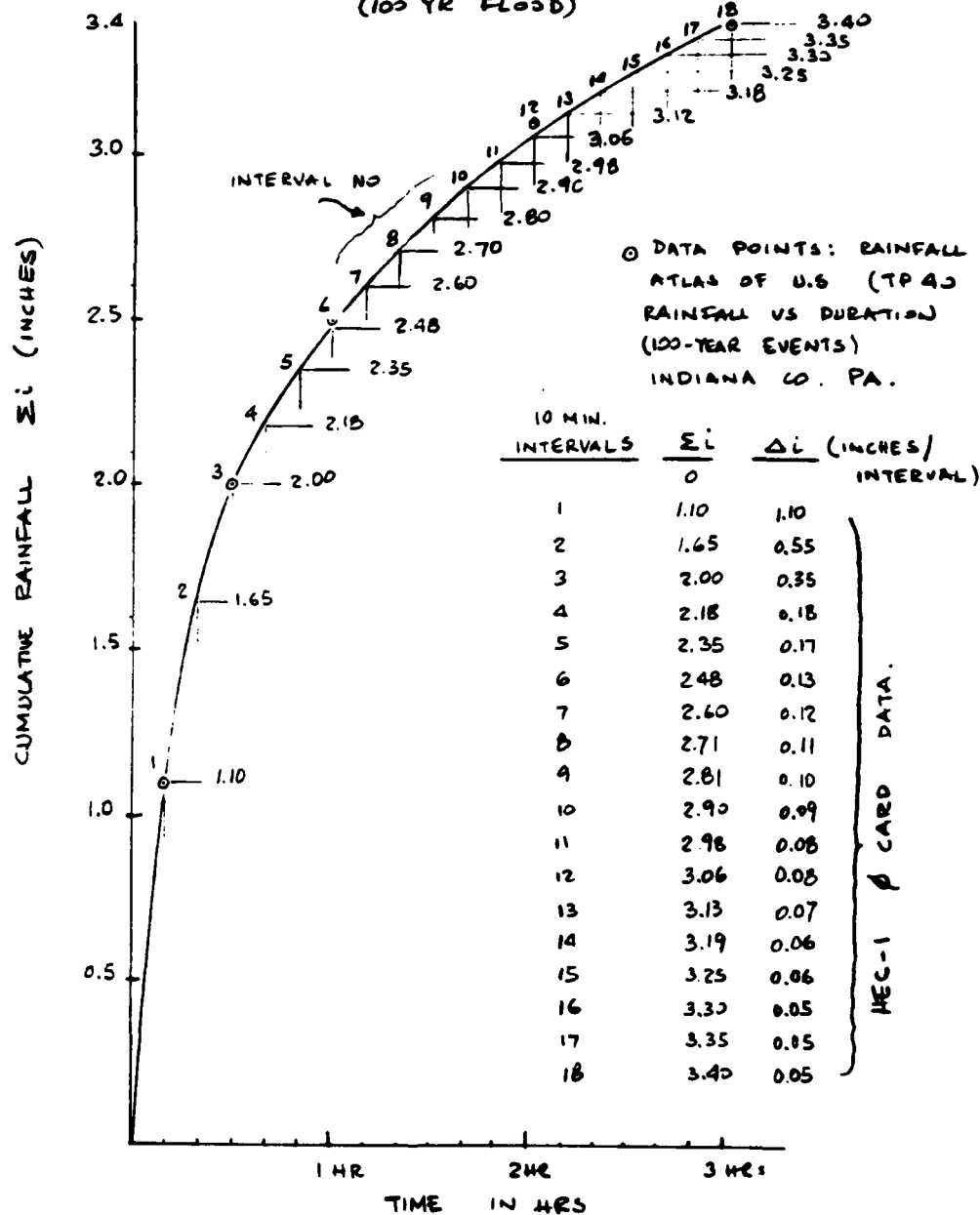
SAY  $Q_{100} = 520 \text{ cfs}$

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# D'AIPIPOLONIA

CONSULTING ENGINEERS, INC.

By BE Date 1/29/80 Subject ELROY FACE DAM Sheet No. 1 of 2  
 Chkd. By WTC Date 1/29/80 CUMULATIVE RAINFALL VS TIME (0-3 HRS) Proj. No. 74-543-15  
 (100 YR FLOOD)



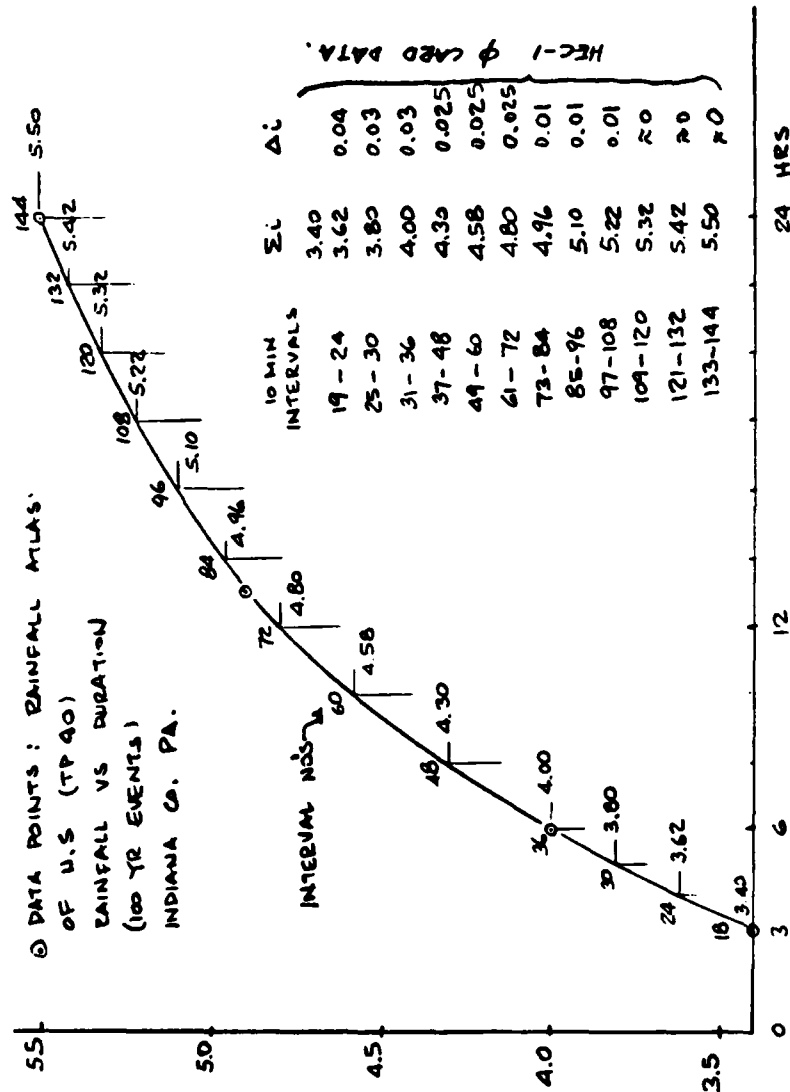
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# D'APOLONIA

CONSULTING ENGINEERS, INC.

By BE Date 1/29/80 Subject ELROY FACE DAM Sheet No. 2 of 2  
 Chkd. By WJR Date 1/29/80 CUMULATIVE RAINFALL VS TIME Proj. No. 79-543-15  
 (100-YR FLOOD) 3-24 HRS



CUMULATIVE RAINFALL Σ i (INCHES)  
 D 10 OF 12

FOR 0-3 HR  
 SEE PAGE 1/2

# D'APPOLONIA

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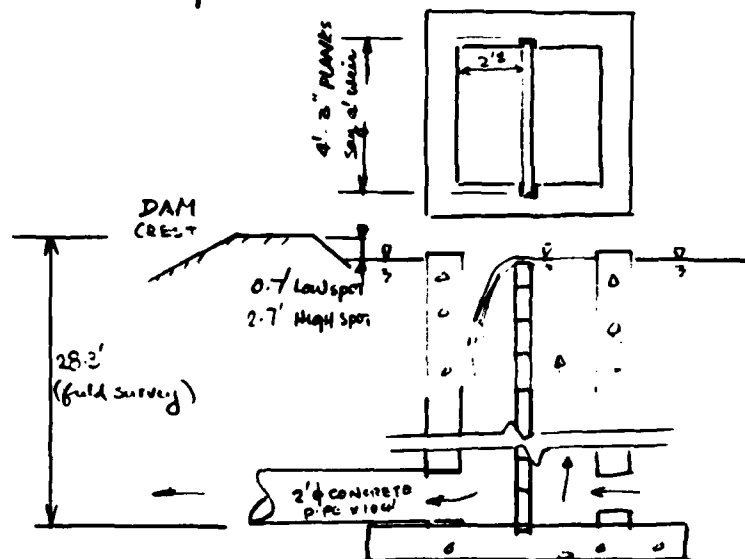
By WTC Date 12-7-79 Subject ELROY FACE DAM Sheet No. 1 of 2  
 Chkd. By MB Date 12/11/79 Proj. No. 79-543-15

## Spillway capacity

THE RESULTS OF NOV 28 1979 FIELD INSPECTION INDICATE

- (1) PRIMARY SPILLWAY CONSISTS OF A CONCRETE TOWER WITH WOODEN PLANKS FOR LAKE

$$Q_1 = 3.1 (4+2+4+2) (H)^{1.5} = 37.2 H^{1.5}$$



- (2) EMERGENCY SPILLWAY  $L = 29'-3"$

THE CREST OF EMERGENCY SPILLWAY IS APPROXIMATELY EQUAL TO THE TOP OF TOWER OR TOP OF PLANKS.

$$Q_2 = 2.6 \times 29.25 \times H^{1.5} = 76.0 H^{1.5}$$

Approach channel depth  $< 3'$  @ ENTRANCE

D 11 OF 12

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# D'APOLONIA

CONSULTING ENGINEERS, INC.

By WTC Date 12-7-79 Subject ELROY FACE DAM Sheet No. 2 of 2  
 Chkd. By MB Date 12/11/79 Proj. No. 79-543-15

## (3) TOTAL COMBINED SPILLWAY CAPACITY

$$\begin{aligned} Q &= Q_1 + Q_2 \\ &= (37.2 + 76.0) H^{1.5} \\ &= 113.25 H^{1.5} \end{aligned}$$

$$\text{COMBINED LENGTH} = 12' + 29.25' = 41.25'$$

$$Q = C L H^{1.5} = 113.25 H^{1.5} = C \cdot 41.25 \cdot H^{1.5}$$

$$\Rightarrow C = 2.75' \text{ USE FOR COMPUTER}$$

$$L = 41.25'$$

DETERMINE MAX. DISCHARGE OF OUTLET PIPE

$$H_T = 28.3' - 2.7' - 0.25D = 23.9'$$

Ref Design of small dam 2<sup>nd</sup> ed. p 564 to 570

$$\begin{aligned} \text{OUTLET CONTROL } H_T &= \left[ \frac{2.5204 (14 K_e)}{D^4} + \frac{466.18 n^2 L}{D^{1.48}} \right] \left( \frac{Q}{10} \right)^2 \\ &= \left[ \frac{2.5204 (140.5)}{2^4} + \frac{(466.18)(0.012)^2 (104)}{2^{1.48}} \right] \left( \frac{Q}{10} \right)^2 \end{aligned}$$

$$Q = 15.6 \sqrt{H_T} \text{ cfs}$$

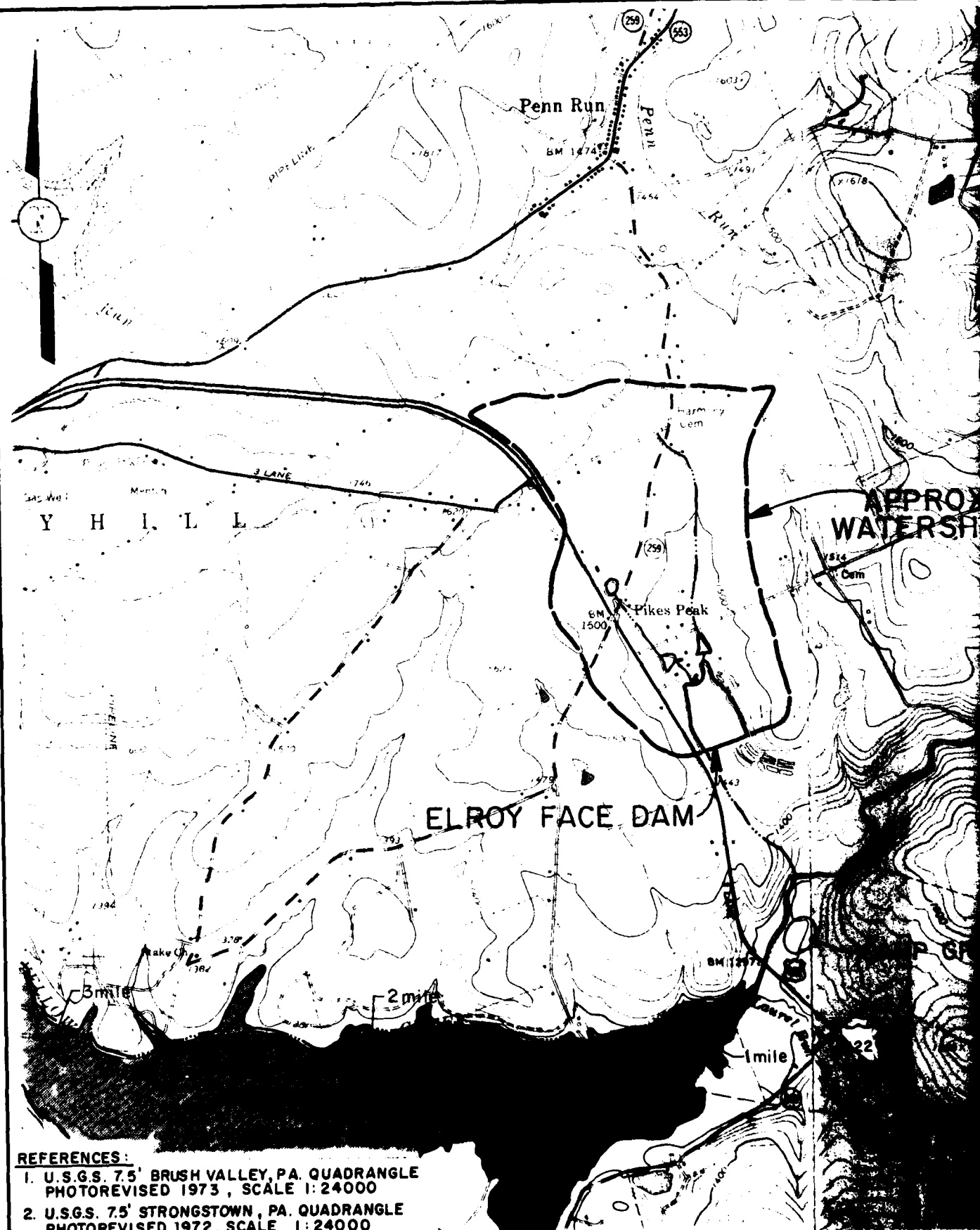
$$\approx 76 \text{ cfs}$$

$$\text{CHECK WEN FLOW } Q_1 = 37.2 H^{1.5} = 76 \text{ cfs} \Rightarrow H = 1.6' \approx \text{FEASIBLE}$$

$$D 12 \text{ OF } 12$$

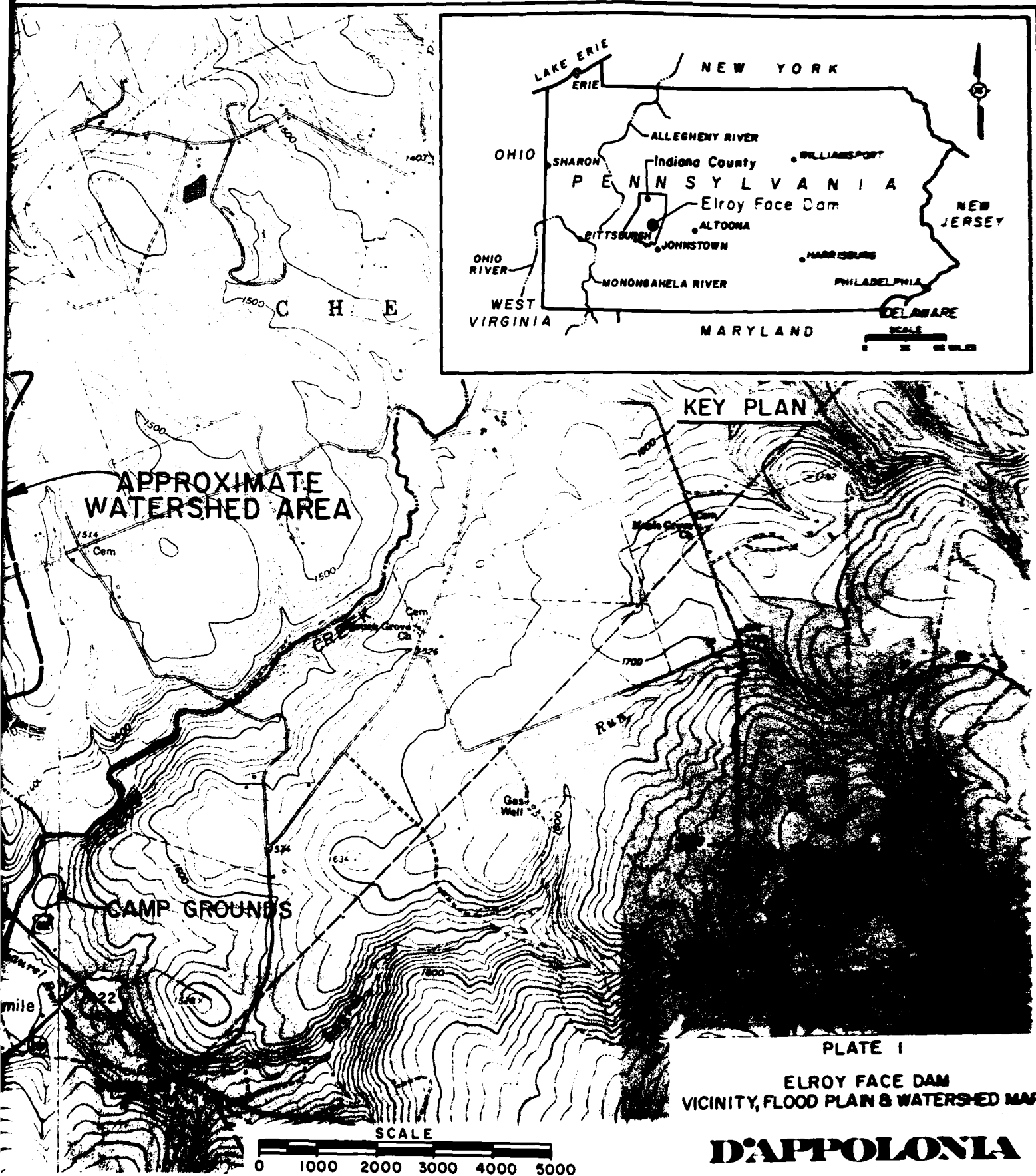
**APPENDIX E**  
**PLATES**

DRAWN BY ACS CHECKED BY *BE* 1/4/83 DRAWING 79-543-B14  
 11-14-79 APPROVED BY *CHC* 7/4/80 NUMBER

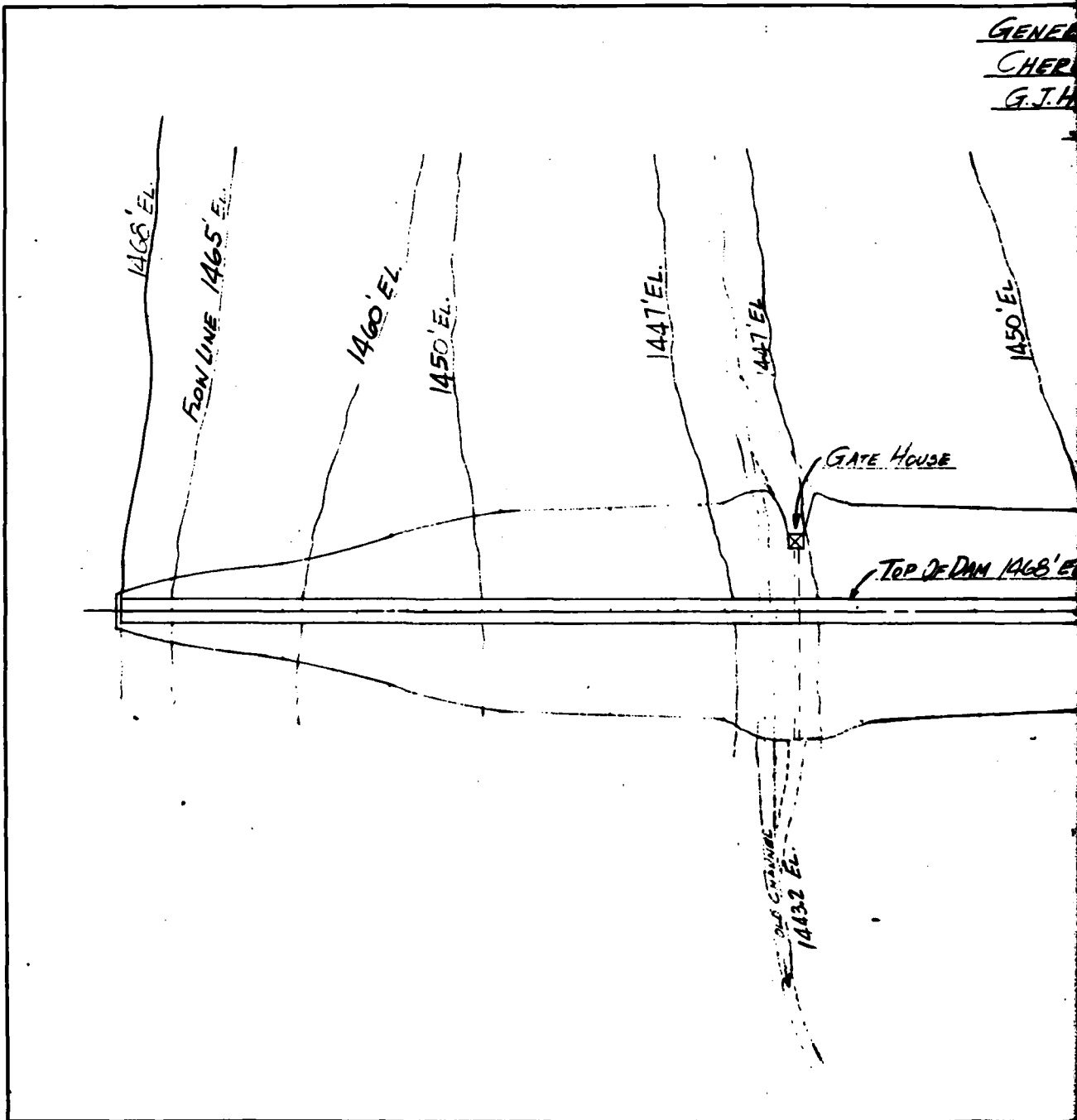


**REFERENCES:**

1. U.S.G.S. 7.5' BRUSH VALLEY, PA. QUADRANGLE  
 PHOTOREVISED 1973, SCALE 1:24000
2. U.S.G.S. 7.5' STRONGSTOWN, PA. QUADRANGLE  
 PHOTOREVISED 1972, SCALE 1:24000



DRAWN BY	ACS	CHECKED BY	1/4/80	DRAWING 79-543-B15 NUMBER
	1-2-80	APPROVED BY	1/4/80	



GENERAL  
CHECKED  
G.J.H.

NOTES:

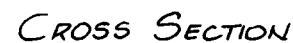
1. PROPOSED DAM : NOT FULLY IN CONFORMANCE WITH AS BUILT CONFIGURATION.
2. ELEVATIONS APPEAR TO BE TO A SITE DATUM NOT IN CONFORMANCE WITH U.S.G.S. ELEVATIONS.

SCALE 1" = 50'-0"



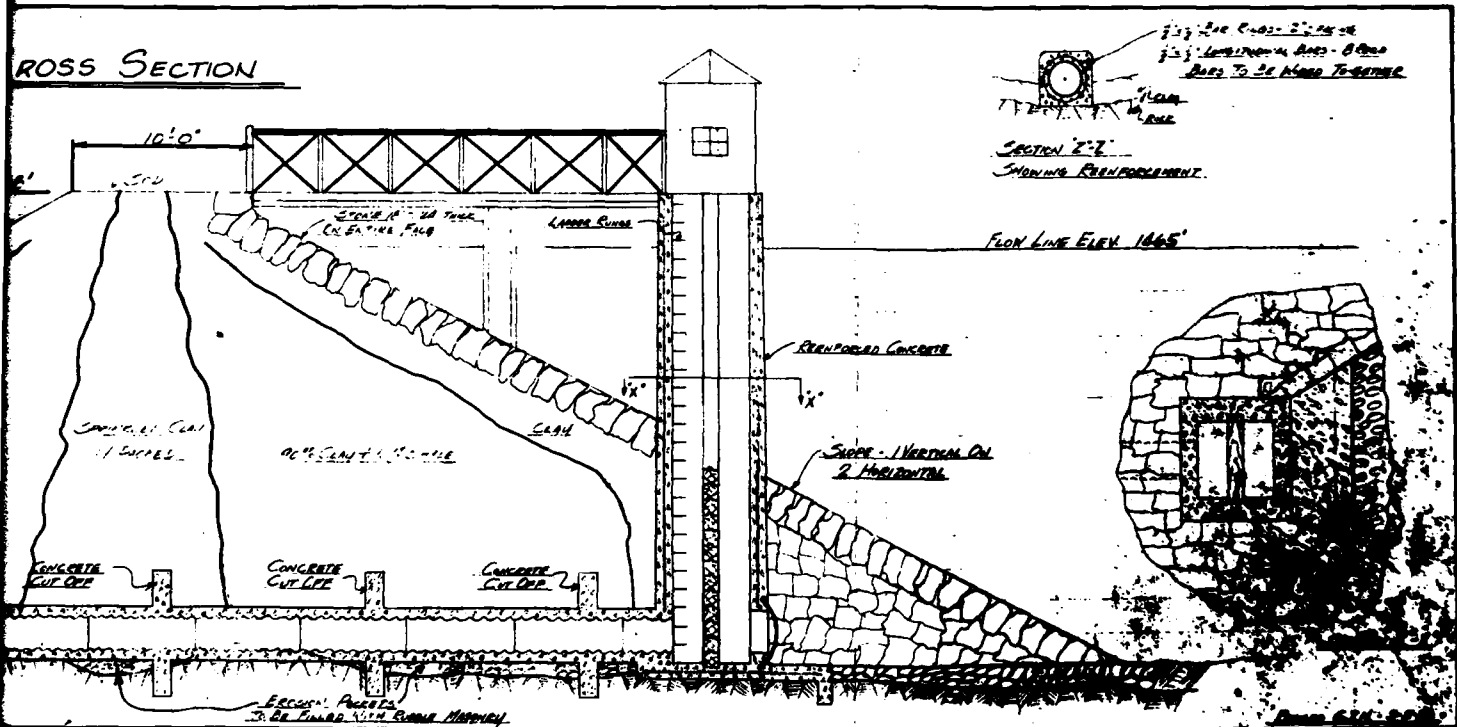


**DRAWING  
NUMBER** 79-543-B16



1. PROPOSED DAM : NOT IN CONFORMANCE WITH AS CONFIGURATION.
2. ELEVATIONS APPEAR TO TO A SITE DATUM NOT IN WITH U.S.G.S. ELEVATION

# ROSS SECTION



PROPOSED DAM : NOT FULLY IN  
CONFORMANCE WITH AS BUILT  
CONFIGURATION.

ELEVATIONS APPEAR TO BE RELATIVE  
TO A SITE DATUM NOT IN CONFORMANCE  
WITH U.S.G.S. ELEVATIONS.

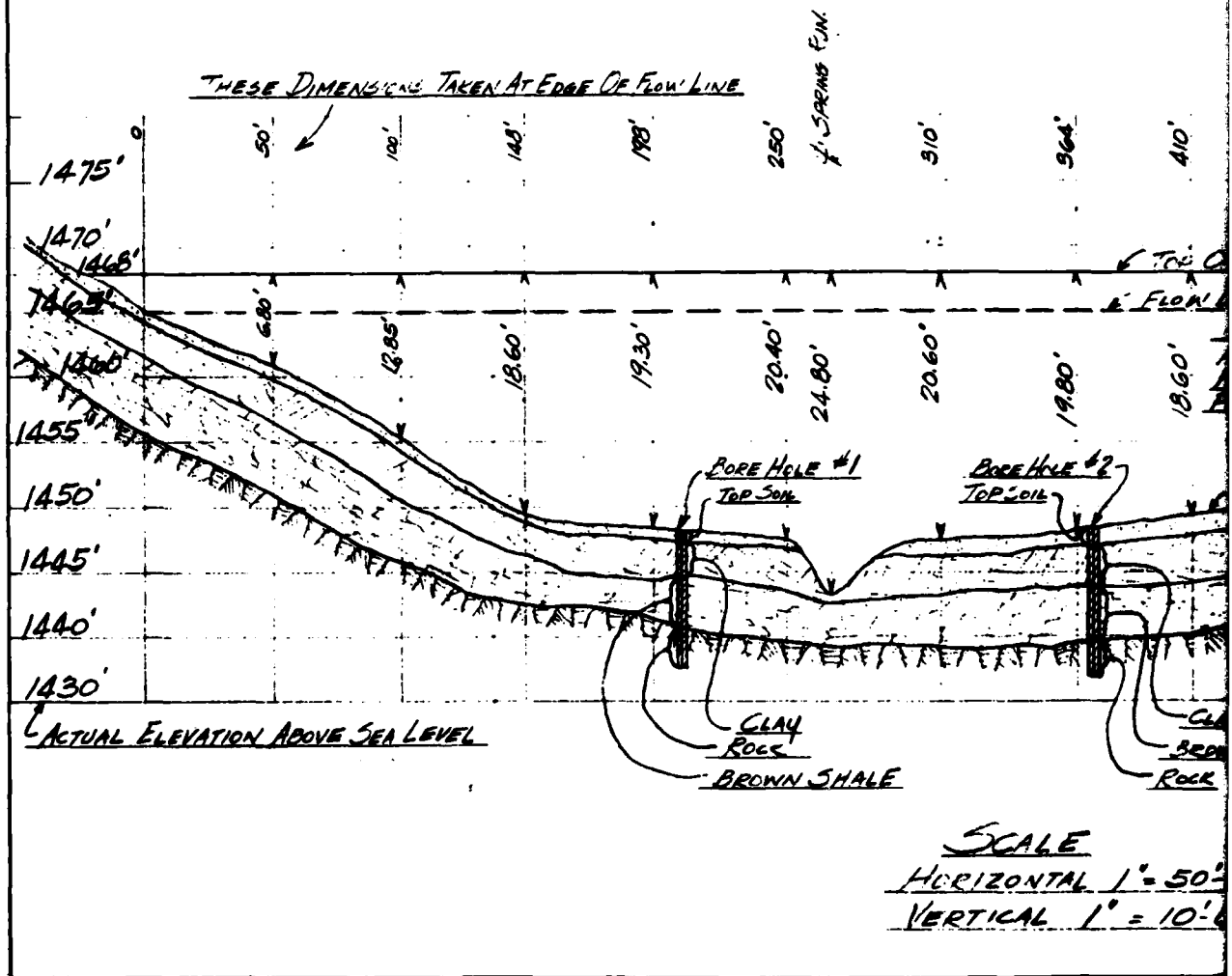
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PLATE 3

D'APPOLONIA

DRAWN BY: ACS CHECKED BY: BC DRAWING NUMBER: 79-543-B17  
 1-2-80 APPROVED BY: BC 1/2/80

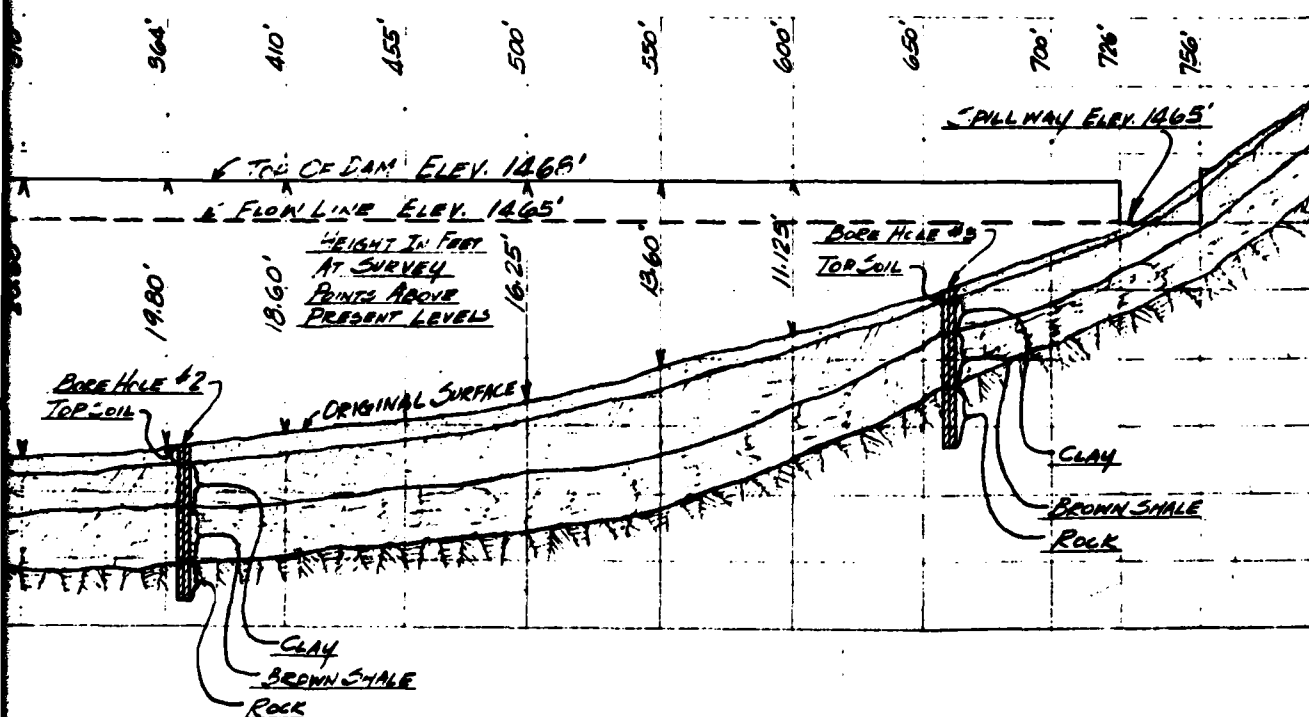
LONGITUDINAL SECTION - PROPOSED  
AT PIRES PEAK PA - CHERRY HILL TR  
INDIANA CO.  
G.J. HORAK NEW KENSINGTON, PA



NOTES:

1. PROPOSED DAM: NOT FULL CONFORMANCE WITH AS CONFIGURATION
2. ELEVATIONS APPEAR TO TO A SITE DATUM NOT IN WITH U.S.G.S. ELEVATIONS

LOCATION - PROPOSED DAM  
 - CHERRY HILL TWP. -  
 Co.,  
 NEW KENSINGTON, PA.



SCALE  
 HORIZONTAL 1" = 50'-0"  
 VERTICAL 1" = 10'-0"

DAM: NOT FULLY IN  
 RMANCE WITH AS BUILT  
 URATION

TIONS APPEAR TO BE RELATIVE  
 SITE DATUM NOT IN CONFORMANCE  
 U.S.G.S. ELEVATIONS

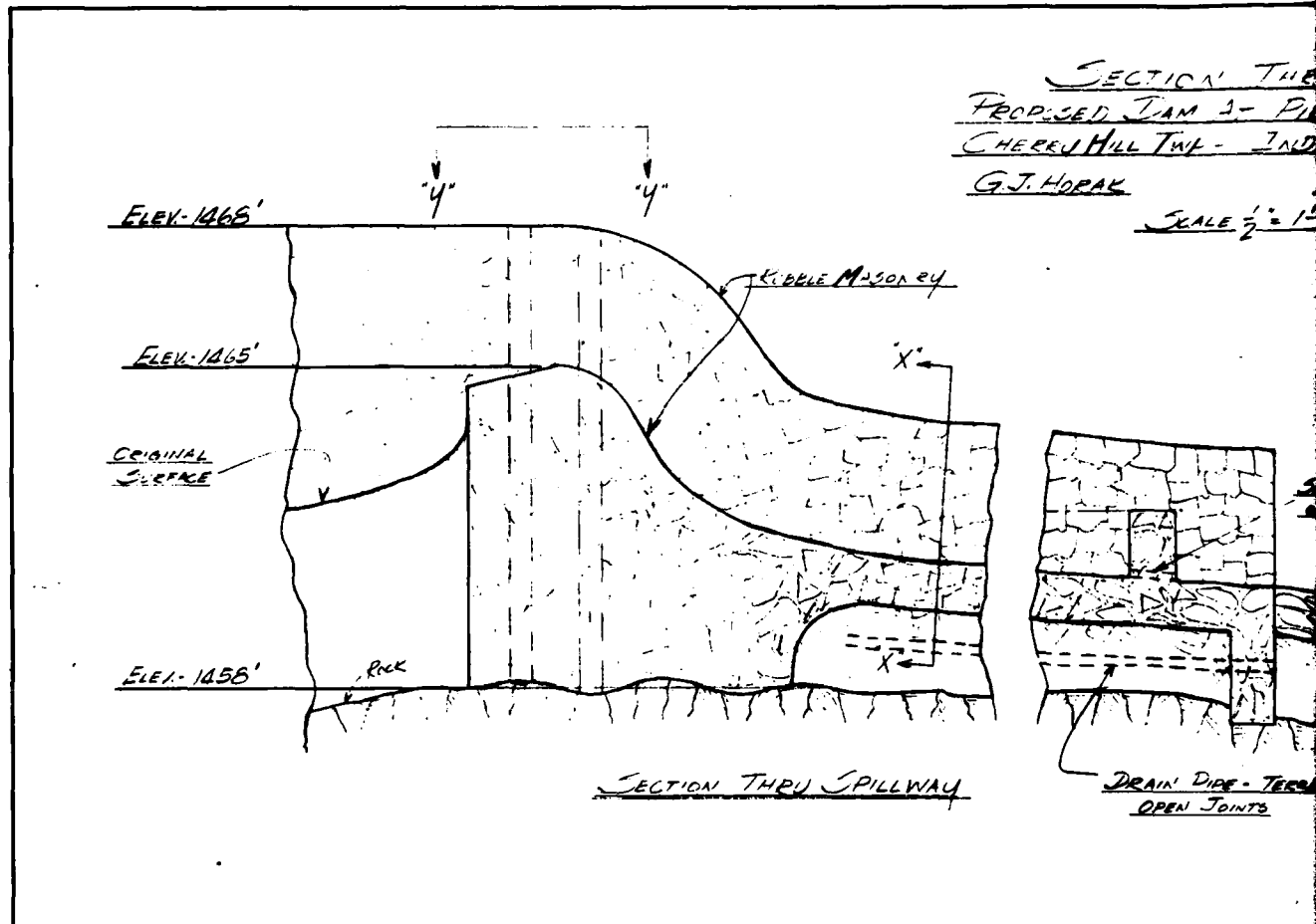
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PLATE 4

**D'APOLONIA**

2

DRAWN BY	ACS	CHECKED BY	1/4/80	DRAWING NUMBER	79-543-B18
BY	1-2-80	APPROVED BY	1/4/80		



NOTES:

1. PROPOSED DAM: NOT FULL CONFORMANCE WITH AS CONFIGURATION.
2. ELEVATIONS APPEAR TO TO A SITE DATUM NOT WITH U.S.G.S. ELEVATION

SECTION THROUGH SPILLWAY

PROPOSED DAM AT PIKE'S PEAK, PA.  
HEERHILL TWP - INDIANA CO.

J. HORAK NEW KENSINGTON, PA.

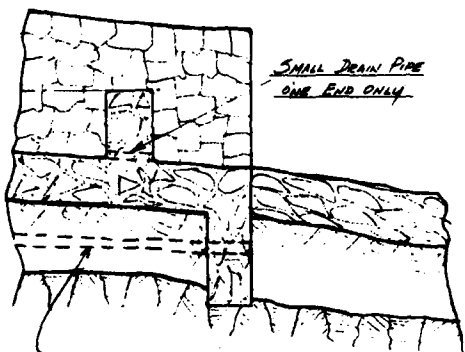
SCALE  $\frac{1}{2}" = 1'-0"$



VIEW 4-4" SHOWING CUT OFF WALL

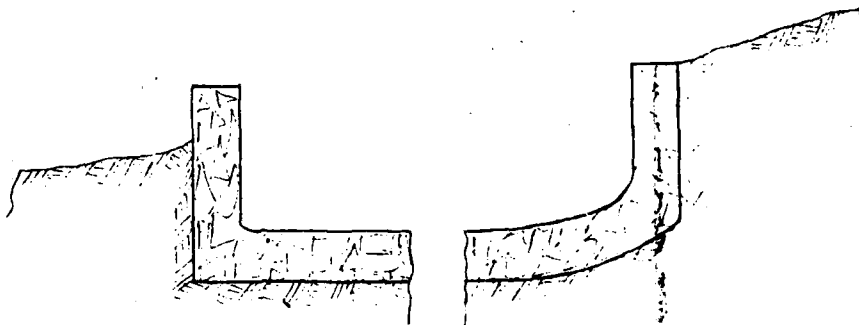
TYPICAL FOR BOTH SIDES OF SPILLWAY

SCALE  $\frac{1}{8}" = 1'-0"$



SMALL DRAIN PIPE  
ONE END ONLY

DRAIN PIPE - TERRA-COTTA  
OPEN JOINTS



SECTION X-X

REVISED G.J.H. - 3-5-30

POSED DAM: NOT FULLY IN  
 FORMANCE WITH AS BUILT  
 FIGURATION.

VATIONS APPEAR TO BE RELATIVE  
 A SITE DATUM NOT IN CONFORMANCE  
 H U.S.G.S. ELEVATIONS

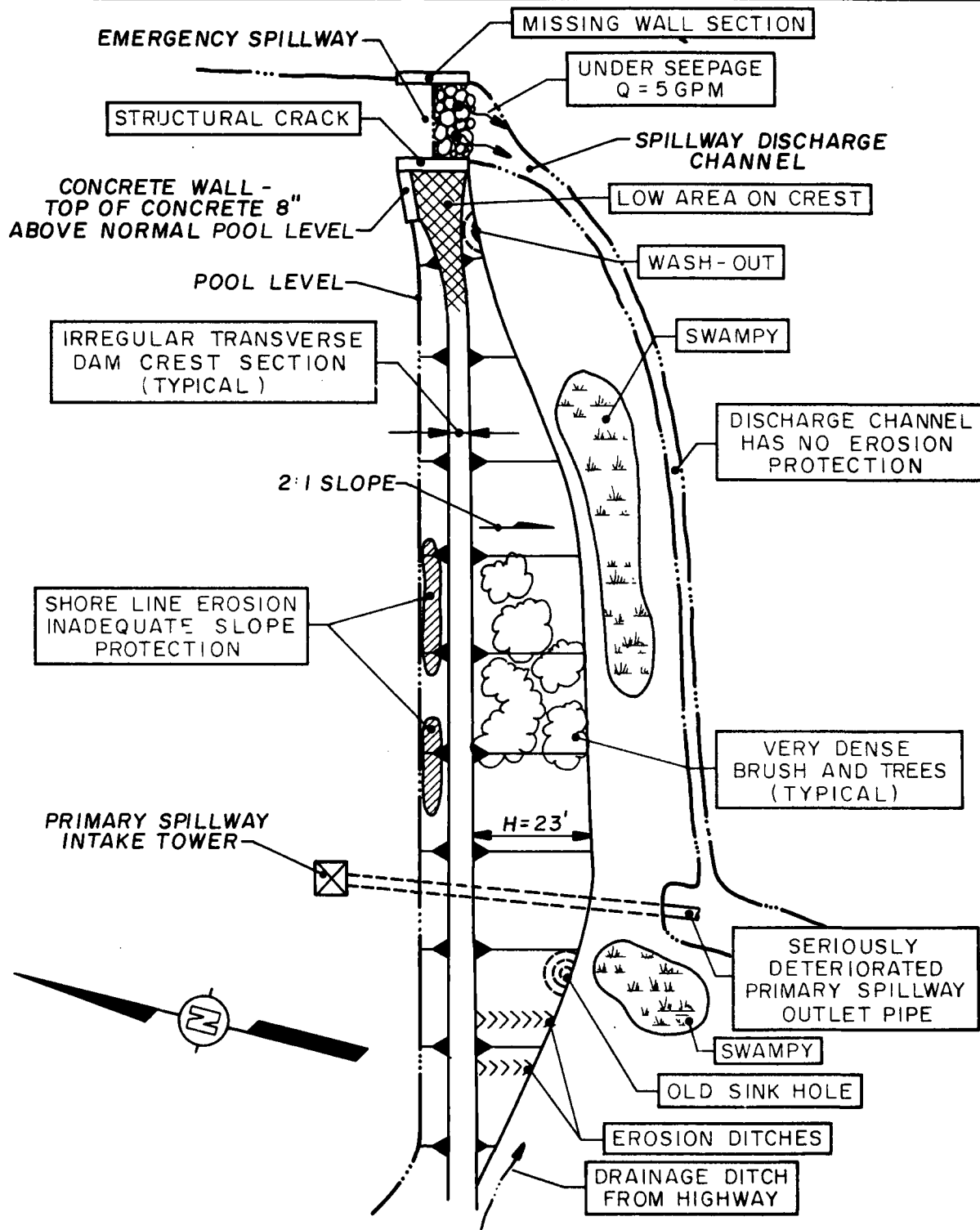
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PLATE 5

**D'APPOLONIA**

2

DRAWING 79-543-A9  
 NUMBER  
 1/4/80  
 1/4/80  
 CHECKED BY BE  
 APPROVED BY JHP  
 ACS  
 12-26-79  
 DRAWN BY



**NOTES:**

- I. POOL LEVEL DATE OF INSPECTION:  
AT EMERGENCY SPILLWAY CREST  
LEVEL.

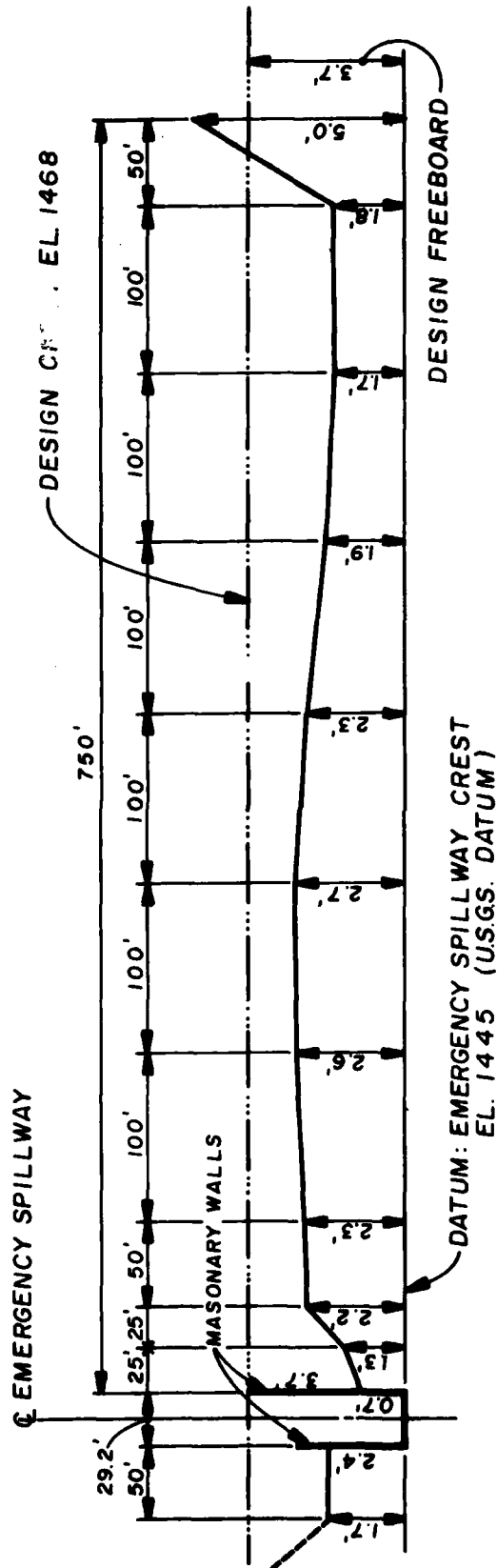
NOT TO SCALE

PLATE 6

ELROY FACE DAM  
 GENERAL PLAN  
 FIELD INSPECTION NOTES  
 FIELD INSPECTION DATE: NOV. 28, 1979

**D'APPOLONIA**

DRAWN BY	ACS	CHECKED BY	1/1/80	DRAWING NUMBER	79-543-A10
	12-26-79	APPROVED BY	1/1/80		



# **DAM CREST PROFILE** (LOOKING DOWNSTREAM)

## **NOTES:**

1. DAM CREST IS SURVEYED RELATIVE TO EMERGENCY SPILLWAY CREST LEVEL.
2. DATUM ELEVATION IS INTERPOLATED FROM U.S.G.S. MAPS. THEREFORE APPROXIMATE.

PLATE 7

ELROY FACE DAM  
DAM CREST SURVEY  
FIELD INSPECTION DATE: NOV. 28, 1979

**D'APPOLONIA**



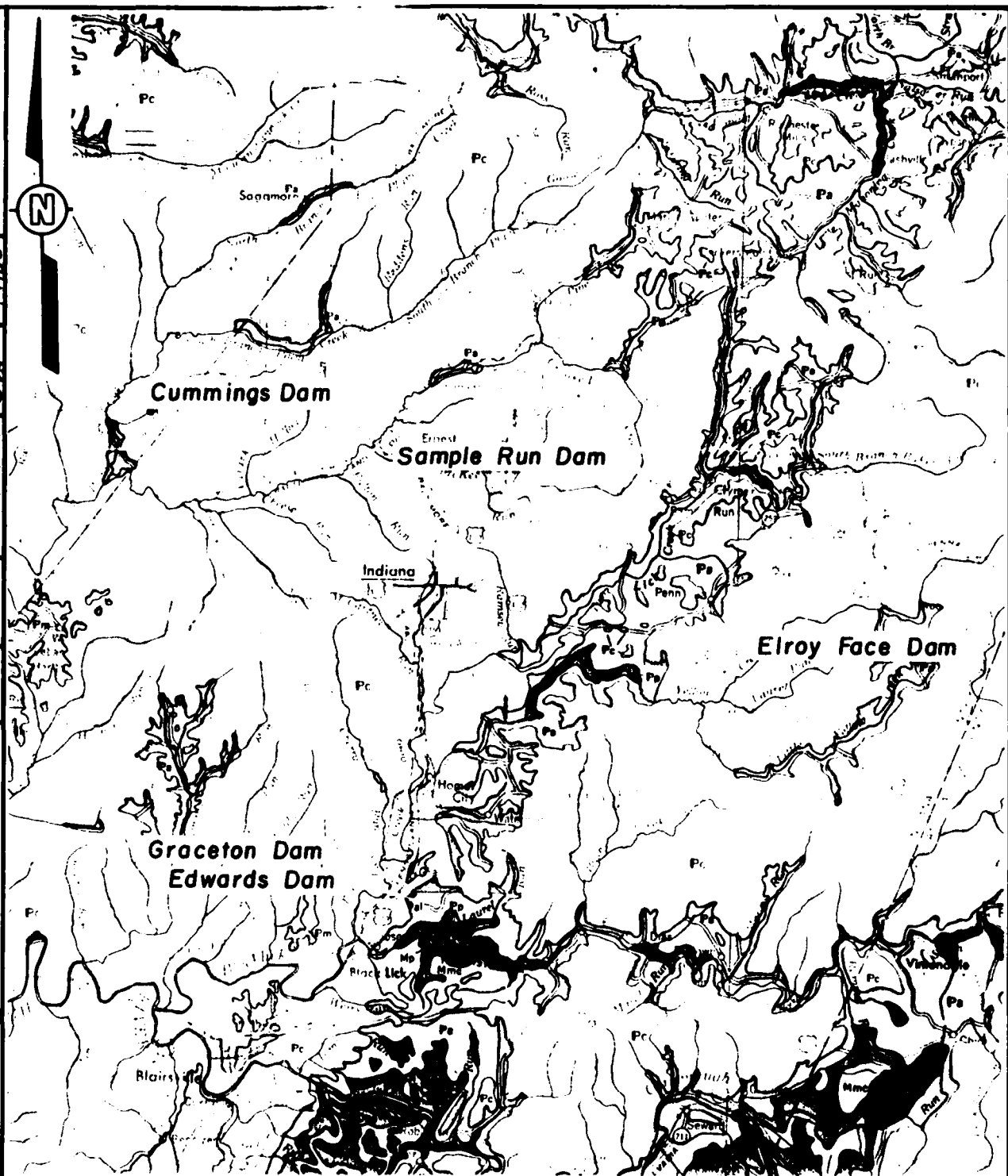
**APPENDIX F**  
**REGIONAL GEOLOGY**

## APPENDIX F REGIONAL GEOLOGY

The Elroy Face Dam is situated on rock strata of the Conemaugh Group, which is characterized by massive sandstones, interbedded shales and siltstones, and claystones. The dam lies along the east limb of the Chestnut Ridge Anticline. Strata near the dam dip to the southeast approximately three degrees.

The Upper Freeport coal outcrops about two miles west of the dam near Yellow Creek State Park Dam and has been locally mined. The Upper Freeport lies under Elroy Face Dam, but has not been mined. Coal seams below the Upper Freeport are thin and high in sulfur and are therefore not considered economically mineable.

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 12-29-79 APPROVED BY JHB NUMBER 11410



SCALE  
 0 2 4 6 8 10 miles

CUMMINGS, SAMPLE RUN,  
 ELROY FACE, GRACETON  
 AND EDWARDS DAMS

GEOLOGY MAP

**REFERENCE:**

GEOLOGIC MAP OF PENNSYLVANIA PREPARED  
 BY COMMONWEALTH OF PENNA. DEPT. OF INTERNAL  
 AFFAIRS, DATED 1960, SCALE 1" = 4 MILES

**D'APOLONIA**

DRAWN BY ACS CHECKED BY JMS APPROVED BY JMD  
 DRAWING NUMBER 79-13-A10

## LEGEND:



**Conemaugh Formation**  
*Cyclic sequences of red and gray shales and sandstones with thin limestone and coals; massive Mahoning Sandstone commonly present at base; Ames Limestone present in middle of section; Brush Creek Limestone in lower part of section.*



**Pottsville Group**  
*Light gray to white, coarse grained sandstones and conglomerates with some mineable coal; includes Sharp Mountain, Shupkill, and Tumbling Run Formations.*



**Allegheny Group**  
*Cyclic sequences of sandstone, shale, limestone and coal; numerous commercial coals; limestone thickens westward; Venport Limestone in lower part of section; includes Freeport, Kittanning, and Clarion Formations.*



**Clinton Group**  
*Predominantly Rose Hill Formation - Reddish purple to greenish gray, thin to medium bedded, fossiliferous shale with intertonguing "iron sandstones" and local gray, fossiliferous limestone; above the Rose Hill is brown to white quartzitic sandstone (Kerfer) interbedded upward with dark gray shale (Rochester).*



**Marine beds**  
*Gray to olive brown shales, graywackes, and sandstones; contains "Chernung" beds and "Pottsville" beds including Burkett, Brallier, Harrell, and Trimmers Rock; Tully Limestone at base.*



**Pocono Group**  
*Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale; includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations; includes part of "Onwego" of M. L. Fuller in Potter and Tioga counties.*



**Oriskany Formation**  
*White to brown, fine to coarse grained, partly calcareous, locally conglomeratic, fossiliferous sandstone (Ridgely) at the top; dark gray, cherty limestone with some interbedded shales and sandstones below (Shriver).*

**Marcellus Formation**

*Black, fissile, carbonaceous shale with thick, brown sandstone (Turkey Ridge) in parts of central Pennsylvania.*

**Onondaga Formation**

*Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places; includes Selinus Grove Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Eopius Shale in easternmost Pennsylvania; in Lehigh Gap area includes Palmerton Sandstone and Bowmanstown Chert.*



**Willis Creek Formation**

*Greenish gray, thin bedded, fissile shale with local limestone and sandstone zones; contains red shale and siltstone in the lower part.*

**Bloomsburg Formation**

*Red, thin and thick bedded shale and siltstone with local units of sandstone and thin impure limestone; some green shale in places.*



**McKenzie Formation**

*Greenish gray, thin bedded shale interbedded with gray, thin bedded, fossiliferous limestone; shale predominant at the base; intraformational breccia in the lower part. Absent in Harrisburg quadrangle and to the east.*

**Keyser Formation**

*Dark gray, highly fossiliferous, thick bedded, crystalline to nodular limestone; passes into Mantua, Roundout, and Decker Formations in the east.*

**Tonoloway Formation**

*Gray, highly laminated, thin bedded, argillaceous limestone; passes into Homardville and Pocono Island beds in the east.*



**Catskill Formation**

*Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.*

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**REFERENCE:**

**GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA. DEPT. OF INTERNAL AFFAIRS, DATED 1960, SCALE 1" = 4 MILES**

**GEOLOGY MAP LEGEND**

**D'APPOLONIA**